REMARKS

The Office Action

In the Office Action dated November 2, 2005, claims 23, 24, 26-29 and 31-33 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,327,955 of Easwaran in view of U.S. Patent No. 5,641,015 of Challand. Claims 7, 8, 12, 25, 34-41 and 43 were rejected under 35 U.S.C. §103(a) as being unpatentable over Easwaran in view of Challand and in further view of either the Pineda et al. 6,551,396 patent (Pineda), the Sahari 5,158,130 patent or the Conroy et al. 5,915,452 patent (Conroy). Claims 1-6, 9-11, 13-17, 22, 44 and 45 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Easwaran in view of Challand and in further view of Carter and Pineda. Claims 18 and 19 were rejected as being unpatentable over Easwaran in view of Challand and in further view of Carter, Pineda and Conroy. Claims 20, 21, and 42 were rejected as being unpatentable over Easwaran in view of Challand and in further view of Carter, Pineda and U.S. Patent No. 4,580,616 to Watts.

In reply, applicants present herewith a request for continued examination, together with an amendment. In this amendment, applicants have amended claim 1, cancelled claims 23-34 without prejudice and added new claims 47-59.

Independent claim 1 was rejected as being unpatentable over Easwaran in view of Challand and in further view of Carter and Pineda. It was admitted that Easwaran in view of Challand failed to teach the use of rapid cooling and removing a portion of a water dispersible mold. It was asserted that Carter teaches the use of rapid cooling, such as simultaneous molten metal pouring and immersion cooling for the purpose of forming a fine grain and reducing oxidation pitting for casting. Pineda was said to teach the use of dropping the mold into water in order to remove or crack a portion of the water dispersible mold. The Office Action went on to assert that it would have been obvious to one having ordinary skill in the art to provide Easwaran in view of Challand the use of rapid cooling and removing or cracking a portion of the water dispersible mold as taught by Carter and Pineda in order to reduce cycle time of casting and to refine the grain size. This rejection is respectfully traversed.

Carter particularly teaches the immersion of its shell mold 20 into its bath 22 "until the molten metal therein solidifies and preferably for some time interval thereafter" since

this "is important in the practice of the invention" (see col. 3, lines 48-51). Moreover, Carter teaches that his shell "must be self-supporting in the sense that it can be moved into the liquid coolant" (see col. 4, lines 32-34). Carter further teaches that his poured mold, with the metal in it still in a fluid condition, should be immersed in the body of liquid 22 and that it should be maintained in the liquid until the molten metal solidifies (see col. 3, lines 26-27). The purpose given in Carter for immersing molten metal, held in a mold, in a liquid bath is that the bath has very high heat transfer properties. Carter particularly notes that the liquid used as a coolant "acts essentially to conduct heat away from the mold and establish a controlled cooling rate" (see col. 2, lines 61-63). Thus, cooling in Carter takes place through the mold.

But, there is no teaching or disclosure in Carter of removing at least a portion of the mold during the process of cooling the molten metal, prior to complete solidification of the molten metal into a casting. In this connection, claim 1 recites the step of cooling the molten metal such that it only partially solidifies into a casting and removing at least a part of the mold. Accordingly, it is respectfully submitted that Carter fails to teach the step of only partially solidifying the molten metal into a casting and the step of removing at least a part of the mold with a solvent when the casting is partially solidified, as recited in claim 1.

Pineda is similarly deficient. The disclosure in Pineda is to various phosphate bonded compositions and molds. But, Pineda particularly discusses the use of the mold to make an investment casting. Not only is the casting allowed to cool down, so is the mold in Pineda. Only after the mold itself is allowed to cool (see col. 6, line 24 of Pineda) is the mold removed. Such removal is by grinding, sandblasting or the like (see col. 6, line 25). Pineda particularly teaches sandblasting with glass beads (see col. 6, lines 27-28). Alternatively, Pineda teaches dropping the mold into water to create a heat differential between the inner and outer surfaces of the mold to crack the mold (see col. 6, lines 29-31). What is clearly missing from Pineda, as it was from Carter, is any teaching or disclosure of removing at least a part of the mold prior to complete solidification of the molten metal in the mold into a casting.

That teaching is similarly missing from Easwaran or Challand. In Easwaran the teaching is to holding a solidifying metal at an elevated temperature, usually from 800° to 1650°F (see col. 5, line 62) for an extended period of time, typically from 10 to 15 minutes (see col. 3, line 64) before the casting is removed. Thus, what is removed is an "as cast"

metal part (see col. 6, line 5). In the first example in Easwaran, steel is held for 15 minutes at 1600°F before the shell is removed by shot blasting (see col. 6, lines 41-44). Similarly in example 2, the steel casting is held at 1650°F for 15 minutes before a water jet is applied to it. In example 3, a ductile iron casting is maintained at a temperature of 1000°F for 10 minutes and then is air cooled prior to blasting to remove a ceramic shell (see col. 7, lines 39-41). Finally, in example 4 a frozen aluminum casting is held at 900°F for 10 minutes before being transferred to a water jet cleaning system. In all of these examples, Easwaran fully solidifies the molten metal into a casting before removing at least a part of the mold. This is in contrast with claim 1.

Finally, Challand teaches a core or mold which maintains its shape throughout the casting process (see col. 1, lines 58-59). Challand's objective is to remove excess water from the mold to ensure that there is no degradation of the mold or core due to the presence of such excess water (see col. 6, lines 30-32). Challand teaches that the removal of the mold is to take place after casting (see col. 9, lines 45-46). But, there is no teaching or disclosure in Challand of cooling a molten metal, such that it only partially solidifies into a casting, and removing at least a part of the mold.

To buttress applicants' arguments, applicants herewith submit a copy of a Declaration under 37 C.F.R. 1.132 which applicants have submitted in the co-pending case, Serial No. 10/614,601. This declaration is by co-inventor John Campbell. Professor Campbell states in paragraph 12 of his declaration that the Carter method of casting is such that the molten metal solidifies completely before the mold is removed. Moreover, paragraph 13 of Professor Campbell's declaration states that Carter teaches the cooling of the casting through the mold. In other words, there is no teaching in Carter that the mold is removed in order to solidify the molten metal in the casting. Thus, the mold cannot be removed during the process of solidifying the molten metal into the casting, when using the teaching of Carter.

As to Pineda, Professor Campbell notes that the teaching of Pineda is to a process in which specified components are used in specified amounts to obtain the right balance of gas permeability, set time and other properties (see paragraph 15 of the Campbell declaration). In Pineda, the mold is allowed to cool before it is removed, such as by grinding, sand blasting or other means. What is important to note is that the mold is allowed to cool before the casting is removed. Since the mold is allowed to cool, the

casting has obviously completely solidified in the mold, before the mold is removed (see paragraph 15 of the Campbell declaration).

Challand is similarly deficient as noted in paragraph 14 of the Campbell declaration. As noted above, Easwaran also teaches that the casting has to be fully solidified before there is any removal of a shell or mold around the casting.

To further support applicants' arguments, enclosed herewith please find a copy of a second Section 132 Declaration submitted in connection with co-pending case Serial No. 10/614,601. This declaration is by Dr. J. Fred Major, a research scientist working for Alcan International Ltd. (Alcan). Alcan is one of the world's largest producers of primary aluminum and a technology leader in this area. In the enclosed declaration, Dr. Major states that to his knowledge, he has never seen any casting process where the mold begins to be removed before the molten metal has solidified into a casting (see paragraph 5 of the declaration). He further states that it is highly surprising to him that Alotech (which is the assignee of the instant application, see the assignment document recorded on September 19, 2003 at Reel 014530, beginning at Frame 0321) has developed a process for casting in which at least a portion of the mold is decomposed or removed before the molten metal has completely solidified into a casting.

In sum, there is no teaching in any of the applied four references of Easwaran, Challand, Carter and Pineda, or any combination thereof, of a process for lost pattern casting of metals which comprises, among other steps, cooling the molten metal such that it only partially solidifies into a casting and removing at least a part of the mold with a solvent while the casting is partially solidified, as recited in claim 1. Therefore, claim 1 is patentable over the applied combination of references, as well as the remainder of the cited art.

Dependent claims 2-6, 9-11 and 13-22 merely further patentably define the detailed subject matter of their parent claim or each other. As such, these claims are also believed to be in condition for allowance over the art of record.

Independent claim 44 was rejected on the same grounds as claim 1. Claim 44 recites a process for the lost pattern casting of metals including the steps of a) cooling the molten metal such that it partially solidifies to form a partially solidified casting; b) contacting the backing and the mold with the solvent to decompose at least a part of the backing and at least a part of the mold; and c) contacting the casting with the solvent to

further solidify the casting. There is no teaching or disclosure of such a process in any of Easwaran, Challand, Carter and Pineda, or their combination. In sum, none of these four references teaches or discloses a) forming a partially solidified casting b) contacting a backing and a mold with a solvent to decompose a part of the backing and at least a part of the mold and then c) contacting the casting with solvent to further solidify the casting.

Accordingly, claim 44 is in condition for allowance over the applied four way combination of references, as well as the remainder of the cited art.

Dependent claim 45 further patentably defines the detailed subject matter of its parent claim. As such, this claim is also believed to be in condition for allowance over the art of record.

Dependent claim 46 recites that in the process of claim 44 the molten metal comprises aluminum and the solvent comprises water.

As discussed in the Campbell and Major declarations, there is no teaching or disclosure in any of the applied or cited art of a casting process wherein the molten metal comprises an aluminum, which is partially solidified into a casting, and contacting the mold with a solvent comprising water, to decompose at least a part of the mold, and then contacting the casting with the solvent to further solidify the casting. None of the cited or applied art teaches a process in which a partially solidified casting, including a molten metal which comprises aluminum, is contacted with a solvent, which comprises water, prior to complete solidification of the casting. In fact, it is highly surprising that such a molding process does not lead to explosions, as noted by Dr. Campbell in paragraph 8 of his declaration. Accordingly, claim 46 is also believed to be in condition for allowance over the art of record.

With further reference to the Office Action, and paragraph three thereof, it was noted that claims 23, 24, and 26-33 were rejected as being unpatentable over Easwaran in view of Challand. These claims have been cancelled without prejudice.

Independent claim 35 was rejected as being unpatentable over Easwaran in view of Challand and further in view of Pineda, Sahari or Conroy. Claim 35 recites an apparatus for the lost pattern casting of metals whereby a lost pattern is at least partially eroded and a molten metal in the mold is cooled and solidified by contact with a solvent to form the casting wherein the solvent erodes at least a part of the mold and the backing, the solvent being delivered via a nozzle.

It was stated in the Office Action that Easwaran in view of Challand fails to teach the use of a water nozzle. Sahari was said to teach the use of nozzles and submerging the mold into water for the purpose of cooling and removing the casting and reusing the binder agent. Conroy was said to teach the use of nozzles and flow rate and pressure of fluid including water and surfactant for the purpose of removing cores from castings. The Office Action asserted that it would have been obvious to one having ordinary skill in the art to - provide Easwaran in view of Challand the use of a water nozzle as taught by either Pineda, Sahari or Conroy in order to effectively make the backing investment softer and easier to remove from the casting metal or to rapidly cool the casting molten state and remove or crack the water soluble mold from the casting. This rejection is respectfully traversed.

As a preliminary matter, Applicant does not agree that it would have been obvious to combine Easwaran with Challand for the reasons stated above. Secondly, even if they were combined, it wouldn't be obvious to provide an apparatus including a nozzle for delivering a solvent with the solvent eroding at least a part of the mold and the backing. Claim 35 recites that the nozzle delivers solvent to contact at least a part of the mold and a part of the backing, the solvent eroding at least a part of the mold and the backing before the molten metal is fully solidified. As noted above, there is no teaching or disclosure of such an apparatus in any of the cited art. Accordingly, claim 35 is in condition for allowance over the art of record.

Dependent claims 36-43 merely further patentably define the detailed subject matter of their parent claim or each other. As such, these claims are also believed to be in condition for allowance over the art of record.

Applicant submits herewith new independent claim 47. This claim recites a process for the lost pattern casting of metals, said process comprising the steps of forming a pattern from a material, forming an erodable coating around at least a portion of said pattern to form a mold, said coating comprising a particulate material and a binder, removing said pattern from said mold, delivering molten metal into said mold, directing a fluid stream at the mold when a casting in the mold is partially solidified, and, dislodging at least a portion of the mold from the casting.

It is respectfully submitted that claim 47 patentably defines over all of the cited art. More particularly, there is no teaching or disclosure in the cited art of a process for the lost pattern casting of metals which include the steps of directing a fluid stream at the mold

when a casting in the mold is partially solidified and dislodging at least a portion of the mold from the casting. As noted in the Campbell and Major declarations, there is no teaching or disclosure in any of the art of removing at least a portion of the mold, such as via a fluid stream directed at the mold, when a casting in the mold is only partially solidified and dislodging at least a portion of the mold from the casting at that time. Rather, all of the prior art teaches fully solidifying the casting before the mold is removed. For example, in Carter, the cooling takes place through the mold. Therefore, the mold must remain in place until the casting has fully solidified. Similarly, in Pineda, not only is the casting allowed to cool down, so is the mold. Thus, what is clearly missing from both Carter and Pineda is any teaching or disclosure of removing at least a part of the mold prior to complete solidification of the molten metal in the mold into a casting. The remaining three references to Easwaran, Conroy and Challand are similarly deficient as noted above. Therefore, claim 47 is in condition for allowance over Carter, Pineda, Challand, Easwaran or Conroy, as well as the remaining art of record.

Dependent claim 48 further recites the steps of removing a pattern from the mold and wherein the step of delivering a molten metal into the mold and the step of removing the pattern from the mold occur approximately simultaneously. There is no teaching or disclosure in any of the cited art of the method recited in claim 48. Therefore, this claim is also believed to be in condition for allowance over the art of record.

Dependent claims 49-53 merely further patentably recite the detailed subject matter of their parent claim or each other. As such, these claims are also believed to be in condition for allowance over the art of record.

Dependent claim 54 recites that the process of claim 53 further comprises the step of permeating the mold with a solvent. It is respectfully submitted that there is no teaching or disclosure of the process of claim 54 in any of the cited art. Therefore, this claim is also believed to be in condition for allowance over the art of record.

Dependent claims 55-57 merely further patentably define the detailed subject matter of their parent claim or each other. As such, these claims are also believed to be in condition for allowance over the art of record.

Finally, new dependent claim 58 recites that the step of cooling comprises the step of using an already cooled portion of the casting as a chill to remove heat from a still molten portion of the casting. There is no teaching or disclosure of such a process in the

prior art. Therefore, this claim is also believed to be in condition for allowance over the art of record.

CONCLUSION

In view of the foregoing, it is respectfully that all of the pending claims are in condition for allowance over the art of record. Such allowance is earnestly solicited.

Respectfully submitted,

FAY, SHARPE, FAGAN,
MINNICH & McKEE, LLP

February 2, 2006
Date

Jay F. Moldovanyi, Reg. No. 29,678
1100 Superior Avenue, Seventh Floor
Cleveland, OH 44114-2579
216-861-5582

CERTIFICATE OF MAILING

Under 37 C.F.R. § 1.8, I certify that this Amendment A is being deposited with the United States Postal Service as First Class mail, addressed to: MAIL STOP AMENDMENT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date indicated below.

Express Mail No.	Signature
EV 690737186 US	Kathleen A. Nimrichter
Date	**Printed Name**
February 2, 2006	Kathleen A. Nimrichter

N:\GISZ\200034\US\KAN0005484V001.doc